

**SCHOOL SCIENCE
(QUARTERLY) NCERT
VOL. 2 1963**

(Reprinted from the Prince of Wales College Magazine, Jammu and Kashmir, December 1912)

THE STORY OF A STONE

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“God worketh slowly: and a thousand years
He takes to lift his hands off. Layer on Layer
He made the earth, fashioned it and hardened it
 Into the great bright useful thing it is:
Its seas life-crowded and soul-hallowed lands
 He girdled with the girdle of the sun.”

Once I had a conference with a pebble, one of those very familiar objects, which one sees everywhere around Jhelum and thinks no more of, and which the very donkeys that carry them on their backs hold in contempt. Certain pursuits in which I have been engaged for some years past have created in him a sympathy with my inquiry, and, in response, he enlightened me on the story of his past. He thus expressed himself:—

“My history is long, and the tale that I have to tell of a long life of restless adventures is almost illimitable. My antiquity is to be measured by periods too vast for your human comprehension, before which the most ancient records of man's history are but as events not even of yesterday but of the last hour. The Himalaya mountains and the seas that wash the Indian shores on the east and west, symbols of time and eternity to man, are, in comparison with the aeons of time that I have passed during my existence on this earth, mere evanescent phases that have come and gone without number. Within my experience, I have witnessed the birth and passing away of many seas, continents and mountains, and these, your important land-marks of the world of today, are the latest comers in a long line of such.

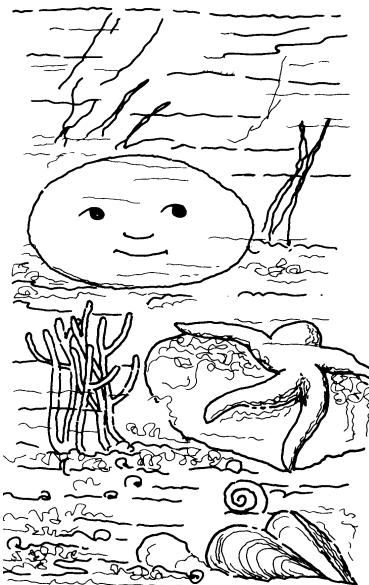


“When I was born, the world was in its infancy, and an altogether different world it was. I cannot exactly recall in detail the geography of the country of my birth. This much, however, is quite certain, that much of the north of India and Punjab of today lay deep under the waters of an ocean, the northern shores of which lay far beyond the plateau of Central Asia. Its southern shores defined a continent in the south, of which the Deccan is a small existing fragment. That graceful pendant, the island of Ceylon, of course did not exist then; it, together with the Deccan, formed part of a continent that stretched far on the other side of the Equator, how far I cannot say—it may be, towards Madagascar on the west and Australia on the east. The one notable feature of this tract of land of which I have a distinct remembrance, (because, as you will learn presently, it was connected with my parentage), was that a high range of mountains ran across it from the site of the present Sahyadris (Western Ghats) to the north as far as the Pamirs. The Aravllis of today are a weathered and shrunk remnant of that lofty pile. The chisel of time has cut deep into them and out of their dust and debris built many a rock-system of India. I hold within me much of its substance and so do many of my congeners in the long line of descent.

“Such was the aspect of the physical world of my day. The world of living beings was stranger still, and far different from anything I have since beheld. It will want an effort of your imagination to realise the picture of that singularly desolate and barren world, from which all the varied and multitudinous races of animals which inhabit it today were absent. There were no quadrupeds, and no boasts of prey ; no birds broke the silence of the air, nor any of the orders of the reptiles broke the gloom of the woods, no frogs, no fishes, even many of the humble invertebrates were absent from the silent deeps of the ocean. They were yet to be born; their advent was but faintly heralded by the few insignificant, but universally spread, lowly class of coral-like animals and some Crustaceans and shell-fishes, which lived in the sea. The land was even more thinly peopled. The hill-slopes and plains were clothed with a sort of vegetation that has its

modern representatives in the lower sea-weeds, mosses and ferns. True, some of these ferns and weeds did shoot their arrogant heads high in the air in the manner of trees of today, but it was a barren splendour only, for, they were devoid of flower, fruit or seed such as you know them. Living upon their scanty products were a few animals mostly of the insect and worm class.

“Now as to my birth, I have said that on the borders of the southern continent i.e. the tract of country now occupied by the Himalayas lay the Sea. The bed of that sea was my birth place. The drainage of the land, gathered by a large river that flowed across it, was discharged, at its mouth, into the sea. Mingled in this water were loads of mud, sand and silt, as is the case with all running water on land. Some geologists, curious in these matters have calculated the rate of waste of solid land by the agency of rivers and rain. They have found that one such river, the Ganges, for instance, conveys 973,000 tons of such sediment daily to the Bay of Bengal. When you consider that not only the Ganges but other great Indian rivers, the Brahmaputra, the Indus, the Godavari, the Narbudda, the Krishna,— some of which carry even more silt than the Ganges—all assist in transporting the solid materials of the continent, you will realise that the waste of the hills and the plains is enormous, and will admit that, as the combined results of the action of all the rivers of the globe, the level of the earth is being reduced one foot in about every 6,000 years. As is the case now, so it was in the past. For in all inquiries of this kind you can take this as a cardinal principle (from us who have been the witness of nature's work since the earth's infancy): **The Present is the Key to the Past.**



“There, deep under the mantle of the ocean, I lay, a sheet of white sand. The successive floods of the river brought fresh loads of sand and these were laid down over those of the last season in a thin layer. Layer after such layer grew, as one tributary after another poured its freight of sediment. It was while I was lying in this condition of loose, unconsolidated sand, on the sea bottom, that I first made my acquaintance with living beings of the period. They flitted about in the waters, or fixed themselves in the growing

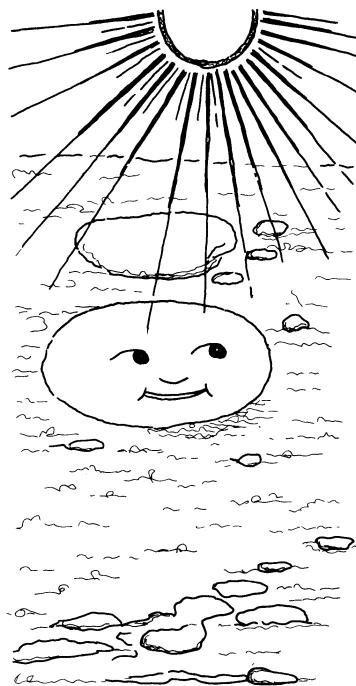
sands, or crawled over them. Some of them were shell-fishes and starfishes, some crustaceans and sea-lilies, others corals and sponges, their uncouth and primitive forms, in contrast with the same animals of today, I yet dimly remember. Their dead bodies, dropped upon the last layer of sand, would lie there till covered by the next deposit of sand brought by the next seasonal flood. Then a curious process would intervene between the organic and the inorganic, and by a slow chemical molecular change, the organic body would be replaced particle by particle, by the inorganic substance of the sand, but still preserving the details of its anatomical structure. Eventually that, relic of the dead animal would be converted into stone, to remain there for ever in its stony sepulchre, to bear witness to many an important fact and circumstance in long subsequent ages. Many such organic fragments, shells and skeletons were entombed in this manner in the bed of sand which was the parent mass from which I was derived. Some of us still bear such *petrified* remains, which you call *fossils*, — chroniclers of the life and conditions of their times. Well, the layers, or strata as you call them, continued to form one over another, each younger one resting on the next older, till in the course of long ages a thickness of some thousands of feet resulted. Under the pressure of this overlying mass, the lower (and older) beds were compacted and consolidated into a hard mass. Infiltrating water carrying limy or silicious solutions introduced these substances into the sand beds; and they, acting as a kind of cement or matrix, converted the once loose sediments into a hard compact rock which you now recognise by the name of sandstone. Thus you see how I was formed out of the silt derived from the wasting of the land, no small part of which was contributed by the hill-slopes and valley-sides of the Aravallis. Up to now my days were happy. Protected under the cover of waters, gathered with my parent mass, I was a stranger to the never-ending change and turmoil of the inorganic world. My life of restless and infinite toil was yet to begin.

“Up to now the compacted and ‘stratified’ beds of sandstone were lying in their original horizontal position over the sea-bed. Then, by some far-reaching titanic process a slow upheaving of the earth began. The strata were compressed from the sides, twisted and folded—solid rock masses as we were—out of their original horizontal and level positions into curious unstable structures of arches and troughs. As a consequence of the upheaving movement, we began to emerge out of the depths of the ocean waters; old Neptune slowly retired from his old domain, and we were left high and dry. In a word the sea-bed was laid bare and converted into land, the new fabric being a piece added to the old southern continent.

“Phenomena so wonderful as the uprise of the sea-bottom to form new land is difficult to conceive, and you are naturally astounded at the magnitude of the operations involved. But look around you and see whether the present geography of the world does not present some identical or parallel phenomena. Here again apply the same principle of inquiry, observe the workings of Nature today, and you will find a clue to its operations in the past. Has not the coast of Sweden for many hundreds of miles lately risen out of the Gulf of Bothnia? The coast of Siberia east of the Lena, for over 600 miles has risen out of the sea and is still rising. The eastern and southern borders of Japan are undergoing a slow elevation, witness the marks on its beaches, and ask its fishermen and sea-captains. The same disturbance of the relative level of sea and land is felt along extensive tracts of

Labrador, Newfoundland and Greenland. But why quest so far? Have not similar things happened within historic times in India? Large areas, once famous historic sites, have been submerged under sea-water and converted into an inland sea, and other areas elevated beyond the reach of the waters to form mounds.

"The coast of Kathiawar, the east coast of the Island of Bombay and the Konkan coast bear marks of recent alternations of the relative level of land and sea, and later still, though on a larger scale, are the changes in Assam and Chittagong. But you must not imagine that these great geographical revolutions were accomplished in a few years or even centuries or that they were brought about by violent or spasmodic action. They were extremely gradual and protracted processes which took ages for their consummation. A hundred generations of living beings roll away before their effect becomes perceptible. Nature draws unlimited cheques on the Bank of Time.



"Our time of trouble had begun. After the first flush of joy at our emerging into light and day we began to perceive our terribly exposed situation. Rain and frost, wind and cold, the insolation of day and night and of summer and winter, all these meteoric agencies began to tell upon the cohesion of the sandstone beds which composed the newly made land. Time, the great agent of ruin, lent its insidious aid to these forces. Percolating water, carrying with it dissolved gases from the air and acids from the around, loosened and disengaged the constituent particles from one another and we soon saw every shower of rain that fell, after seasons of drought, carried away with it tons of sand and other disintegrated matter from us. Cracks and crevices appeared; they widened into fissures and admitted more air and water —the two chief agents in rock-decomposition into deeper parts. Another factor which helped in altering the surface was vegetation, which had taken hold on the ground and spread on it. While at first it seemed to protect the surface from the atmospheric wear and tear of the ground, by means of its various organic

acids and the oxygen and carbonic acid gas of the air which were introduced into the subsurface by the mechanically penetrating roots and rootlets it produced a layer of rotted rock mixed with the debris of the vegetation,—the soil. This growing soil-cap by supporting vegetation more actively only accelerated a further disintegration of the layers deeper and deeper. Meanwhile the rains of all these ages had worked a marvellous change on the originally smooth, uniformly sloping surface of the ground. The precipitated water in descending to lower levels cut tunnels; these, gathering strength, had formed into streams, which joined to form rivulets. By wearing out the softer parts more readily than the harder, and by eating into the sloping parts more actively than the level tracts, it brought about great inequalities in the originally uniform surface. In what was once a level plateau, hollows and ridges, mounds and depressions, hills and valleys were carved out by the energy of the running water as by the chisel of a sculptor. Landslips were precipitated along slopes by the lubricating action of percolating water along crack-planes. Thus the denudation, by the atmospheric agencies changed the face of the new land and gave to it the ordinary worn aspect which is such a feature of land scenery in all parts of the world. Of course all this went on as the normal routine of Nature, taking vast measures of time and just as naturally as you now see things going on around you.

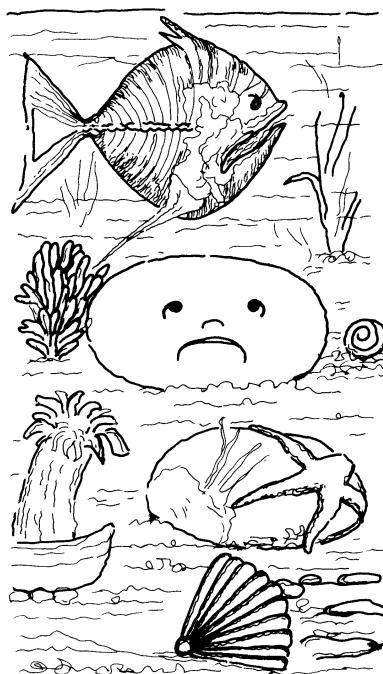
“In one of these land-slips I was thrown from a hill-side into the valley below. Thus detached from the parent home once and for ever, I lay in the fallen debris, a rough-hewn sharp-edged, massive block of sandstone, utterly unlike my present diminutive shape. Time rolled away. Torrential streams swept us along the river course. Each roaring debacle in rainy season carried us along with other blocks, knocking against one another and against the hard bed of the stream. Through new scenes and new lands we were rolled along and rubbed and scoured till even the hardest of us lost our original form and were reduced and rounded into boulders. New stranded on some shingle bank, now dropped for a time on some sharp bend, now left high and dry for a long succession of rainless summers in the parched-up bed of the river, the ruthless transport continued. Eventually we reached the shores of the sea,—the great ‘Tethys sea’ of geologists, which stretched hem the eastern extremity of the Himalayas to the north-west as far as the western limits of the Swiss Alps, “There we were carried and dropped into its shallow waters, together with myriads of other boulders, pebbles, sand and other debris. Once more on the bed of the sea, we were cemented into the rock called conglomerate. Ages pass away, the great Tethys (as this ancient Himalayan Sea is named) vanishes for a time and the rocks laid down on its bottom are uplifted and converted into dry land. Time and the weather again do their appointed task and after countless centuries we are once more set at liberty as loose stones and boulders, but only to be made again the sport of livers and of the waves. Passing through these, we find ourselves once more on the leach of the Tethys which had returned to its former coasts after its temporary regression to the north. There, subject to the fury of the waves, hurled high in the air along their crests and rammed against the abutting cliffs, we worked our way once more beneath the water. Rounded by the constant rolling, reduced in size by the perpetual attrition, but otherwise unchanged, I yet held my own. But this ceaseless wear and tear had by this lime ground into dust and sand most of my comrades. Thanks to the crystalline structure and inherent hardness of my grain, this fate did not befall me.



“Once more I became sealed up in a hard rock-bed. A great depression of the bottom of the Tethys commenced and continued for long periods which carried us some thousands of feet below the surface of the earth. A thick series of strata was deposited over the slowly sinking sea floor, and we lay in complete oblivion of everything in the deep plutonic regions of the earth's crust. Pressure and internal heat of the earth imparted to us a new grain and molecular structure. What vast aeons of time succeeded since I thus lay deep in the bowels of the earth, and what, the history of the earth may have been during these epochs, it is not possible for me to tell. I can only say, that period was long enough for many widespread and striking changes to take place on the face of the globe—many lands with their highlands and mountains were denuded to their roots, many new rivers, valleys and lake-basins were formed, effaced and reformed; the coast-lines of all the countries were changed beyond recognition; in a word, the whole geography of the world was profoundly altered. In the learned language of Science, this era during which I lay *perdu* is known as the Mesozoic era of the Earth's history and represents the passing away of three great divisions of geological time—the Triassic, the Jurassic and the Cretaceous. The next succeeding era—the Cainozoic—was ushered in by a great reverse movement of upheaval of the sea floor, which put an end to the conditions of the Mesozoic times : the Tethys was driven back by the steady uprise of its bottom and finally obliterated, leaving behind only the modern Caspian and the Mediterranean as its shrunken relics. The strata were wrinkled and plicated into earth-folds by the gigantic up thrusts which ensued. The forces of Pluto were gathered underground to produce the last and mightiest change on the face of our planet —the upheaval of the Himalayan chain of mountains on the site of what was once the bed of the Tethys. Scarcely was this revolution complete and the forces of Nature were settling down to their equilibrium, when the claw of the weather dug me out of the rock-bed, once again to play the part of a rolling stone and repeat my wanderings along the sea-beach or the river-bed. I will not

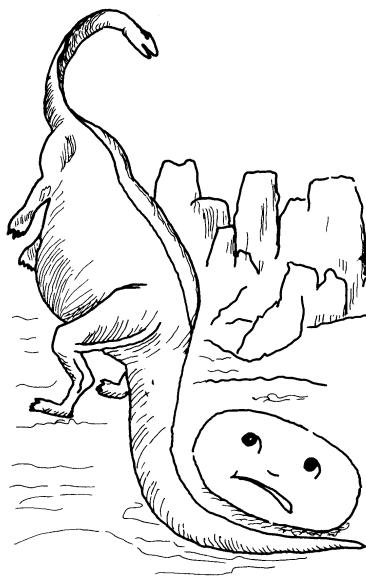
tire your patience by detailing all my doings since then. Incessant and never-ending change seemed to be my destiny. The rolling, founding and attrition, in rivers and torrents of the new mountains, went on, fitfully and with long pauses, till at length I reached the edge of the Himalayas. Abroad estuary was then covering the site of the present Siwalik foot-hills of the Punjab and among the deposits that were forming there (out of the debris of the newly risen Himalayas) I was dropped—my last station and present resting place—at the identical spot you discovered me in.

“Thus I came to a brief respite from the wanderings of ages, but my journey's end was not yet.



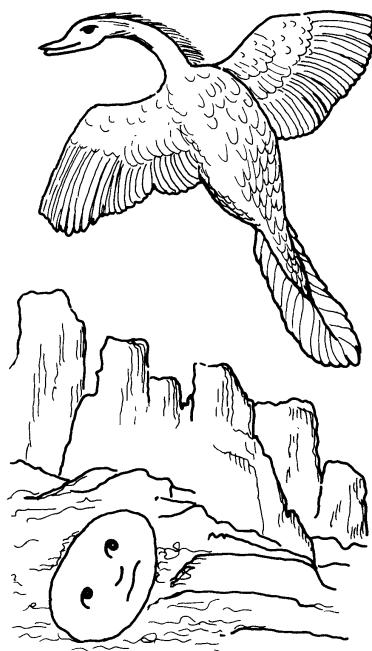
“Amid all my peregrinations so far, since the infancy of the earth, what worlds of living beings both plants and animals, I have beheld! Let me tell you briefly of some of the more remarkable of these inhabitants that successively peopled the earth. In the early part of the narrative I have told you of the impoverished condition of the world when I was born in the era, known in Geology as the Palaeozoic era. All the organic creation was then primitive, simple and generalised, in contrast with the varied and more specialised fauna and flora of today. In them, it almost seemed Nature had tried her ‘prentice han’.’ But as this time passed, new animals appeared and the older tribes died out, never again to appear. One notable feature of these successive creations was the progression from lower to higher types of animals as well as plants; species multiplied and the general total of life forms became more varied but less cosmopolitan. The first important advance, since my days, was the appearance of Fishes of a great variety of size and structure. They were quite unlike the modern fishes, and their curiously shaped bodies were encased in large plates of bone. Passing beyond the 'age of Fishes,' the next remarkable period—the Carboniferous period of geological history—was one in which frog-like creatures appeared for the first time. The landscapes of the time were being rapidly changed now

by the profusion of vegetable life, which flourished in rank abundance, thick matted jungles of fern and horsetail on every foot-breadth of the soil. But from these woodlands anything higher than the seed fern type of vegetation was absent; their gloomy monotony being broken by huge frog-like creatures—the highest class of animals then living—that hunted them. Their disproportionate and ungainly bearing ill suited their dignity as the monarchs of the animal world. This period of vegetable supremacy having closed with the Carboniferous, there next came a period in which enormous Reptiles were the order of the day. But of these times—the Mesozoic—I have no personal knowledge, being buried in oblivion deep under the bowels of the earth, as I have just said. My neighbour, this block of limestone, is of Jurassic limestone parentage and tells me the story of his times. He even possesses, entombed within him, many precious relics of the life of those days. In the air, on the land, and in the water there were reptiles of monstrous sizes and shapes. Those weird, uncouth giants then fulfilled by means of their various structural adaptations and offices now held by mammals. You cannot imagine a lizard as large as an elephant, yet the *Iguanodon* fully equalled, if it did not surpass, him in size. One singular creature—the *Plesiosaurus* was truly the monarch of the seas. With the head of a crocodile it carried a neck which resembled the entire body of a python, a trunk like a bison, the ribs of a lizard and the paddles of a whale. A fish-like dragon, the dreaded *Ichthyosaurus*, more than 30 feet in length, traversed the depth of waters in search of food, that half killed its prey by the stony stare of its eyes, which were a full foot in diameter. Winged dragons, the *Pterosaurs* careered through the air and filled the landscapes with their curious forms. The Jurassic and Cretaceous rocks of all parts of the world are full of proofs of what I say, for they contain enclosed within them the petrified bones and other remains of all these strange creatures.



“But before the Mesozoic era closed, this over-grown class of reptiles had all but passed away. The very advantages which gave them superiority over the other races in their day, viz., their large size and highly specialised organisation, unfitted them to withstand the rigours of altered circumstances which the succeeding age brought, and they lost in the keen race for struggle for existence against the less specialised but more hardy and agile

races. Before they became extinct, a new and higher class of animals had emerged on the stage of creation, the class of Birds. Wonderful as it may sound, the birds originated directly out of the reptiles. First there were bird-like reptiles and then there came true birds but with several reptilian characters. The first such type that arose—the one known as *Archaeopteryx*, in the barbarous terminology of geology, had, instead of the graceful beak of the living birds, formidable jaws set with rows of sharp teeth, and possessed a long tapering tail like that of a lizard.



“Followed the Cenozoic era—the era of modern creation with many living orders of animals and plants, the era in which immense Mammals were the kings of the earth. The old-world families and orders of fishes, amphibians, reptiles and birds had become extinct and their place was taken by newer and more modern forms. The earliest progenitors of the mammals were the Marsupials and their allies. These early quadrupeds had combined in them characters and structural plans of many widely separated orders which were to come later in time. Each succeeding epoch introduced new forms more and more like the living denizens of the world of today. The great carnivores, horse, pig, camel, elephant, rhinoceros, hippopotamus, cattle, deer, and ape came in due time : the grand inarch of life continued, till almost at the close of the era, came Man at the head of the procession, the last-comer on earth of all its animals. Man's entry on the stage of the world coincided with an extreme change in the climate. Sheets of ice covered the northern world, while even down to north Punjab, rivers of ice flowed down draining the vast ice-caps of the highlands. This refrigeration slowly culminated into an Ice Age for the whole of the northern world down to the latitude of 39 degrees, as the Himalayas completed their elevation. Then the ice slowly retreated and the climate became milder.



“In the preceding narrative I have given you a brief outline of my autobiography. My future I begin to perceive dimly, though yet in a far distant age. Do you hear the roar of the river water? It is the requiem being sung by it as it carries many of my brethren to their doom --their dismemberment into fine impalpable silt. The same fate awaits me as sure as death. For look at the river-bed and you will discover what is going on there. Myriads of the boulders and pebbles from this place are torn from their site by its hundreds of tributaries in the monsoon, and are being carried away grating against one another and against the floor. They are pushed on till the burden is transported to the Jhelum, to undergo the same grinding; till the Jhelum in its turn transfers it to the Indus. There mingling with its own enormous load of sediment, washed away by itself and its hydra-headed tributaries from the uplands and plains of northern India, it is propelled onwards. Big boulders are reduced and rounded into small ones, these into pebbles, the pebbles are again ground into sand-grains and the sand-grains are still further reduced or decomposed into the finest particles of silt and clay. When the Indus's journey is finished, the whole freight is discharged at its mouth into the Arabian Sea - pebble, sand, and silt, there in its tranquil depths to rest for a time in horizontal sheets and layers on its floor. Out of these are formed the future sandstone, conglomerate and shale's, the bricks and mortar of new lands. These will, on some distant day, be uplifted from their depths, and out of their ruins again, will be built newer lands, mountains and continents. Thus the process goes on in Nature in a never-ending cycle, decay and renovation succeeding one another as they have done again and again in the past, as this narrative of my humble—because of a mere stone's-existence has shown you.”

Reader, in this story of the humble pebble of stone we have learnt some lessons in Geology, and got some insight into the hidden ways of Nature.

(P. S.—The pebble, the subject of the above narrative, is of white quartzite of older Paleozoic Age occurring in the Pir Panjal range of Kashmir. Such pebbles occur

commonly in the Siwalik deposits (late Tertiary) of the Himalayan foothills along their entire length from the Punjab to Assam, D. N. W.)